

FORM PTO-1390 (Modified)
(REV 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

217798US2PCT

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

10/019314

INTERNATIONAL APPLICATION NO.
PCT/FR00/01914INTERNATIONAL FILING DATE
4 July 2000PRIORITY DATE CLAIMED
9 July 1999

TITLE OF INVENTION

SECURED DOCUMENT, SYSTEM FOR MANUFACTURING SAME AND SYSTEM FOR READING THIS DOCUMENT

APPLICANT(S) FOR DO/EO/US

JOUBERT Cecile et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☒ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

PCT/IB/304/Drawings (7 sheets)

PCT/IB/308/Notice of Priority/Form PTO-1449

Amended Sheets (Pages 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 11a, 16, 17, 18, 19 and 20)

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 10/019314)		INTERNATIONAL APPLICATION NO. PCT/FR00/01914		ATTORNEY'S DOCKET NUMBER 217798US2PCT	
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24. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :				CALCULATIONS PTO USE ONLY	
<input type="checkbox"/>	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	\$1040.00			
<input checked="" type="checkbox"/>	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	\$890.00			
<input type="checkbox"/>	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	\$740.00			
<input type="checkbox"/>	International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)	\$710.00			
<input type="checkbox"/>	International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	\$100.00			
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	28 - 20 =	8	x \$18.00	\$144.00	
Independent claims	3 - 3 =	0	x \$84.00	\$0.00	
Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$1,034.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				\$0.00	
SUBTOTAL =				\$1,034.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$1,034.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).				<input type="checkbox"/>	\$0.00
TOTAL FEES ENCLOSED =				\$1,034.00	
				Amount to be: refunded	\$
				charged	\$

a. ☒ A check in the amount of \$1,034.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.


c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 15-0030 A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Surinder Sachar
Registration No. 34,423



22850

SIGNATURE

Marvin J. Spivak
NAME

24,913
REGISTRATION NUMBER

Jan 9 2002
DATE

217798US

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: :
CECILE JOUBERT ET AL. :
SERIAL NO: NEW U.S. PCT APPLN : ATTN: APPLICATION BRANCH
(Based on PCT/FR00/01914)
FILED: HEREWITH :
FOR: SECURED DOCUMENT, SYSTEM
FOR MANUFACTURING SAME
AND SYSTEM FOR READING THIS
DOCUMENT

PRELIMINARY AMENDMENT

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Prior to a first examination on the merits, please amend the above-identified
application as follows:

IN THE CLAIMS

Please cancel Claims 1-28 without prejudice.

Please add new Claims 29-56 as follows:

29. (New) A document comprising at least one drawing or data produced by
deposition or inclusion of pigments or dyes which can be read optically, and a hologram
made from a copy of said drawing or said data, wherein the hologram comprises
deformations introduced during its recording which make the copy read from the drawing or
from said data different.

30. (New) The document as claimed in claim 29, wherein the deformations are aberrations.

31. (New) The document as claimed in claim 29, wherein the deformations are scattering effects.

32. (New) The document as claimed in claim 29, wherein the hologram is superimposed onto at least one photosensitive layer with a coding function.

33. (New) The document as claimed in claim 32, wherein said photosensitive layer is a diffraction grating.

34. (New) The document as claimed in claim 32, wherein said photosensitive layer contains specific but not personalized data, identical for all documents of a same type.

35. (New) The document as claimed in claim 32, wherein the coding function comprises at least one of the following optical properties: colorimetry with multiple angular ranges of visibility, high-resolution visible with an additional source.

36. (New) The document as claimed in claim 32, wherein the hologram and the photosensitive layer are combined by an anti-peel bonding means.

37. (New) The document as claimed in claim 29, wherein the hologram is transparent so that data located under the hologram, on the document, can be read.

38. (New) The document as claimed in claim 29, wherein the hologram can be read only under lighting of certain wavelengths.

39. (New) The document as claimed claim 29, wherein the hologram can be read at different wavelengths from different angles.

40. (New) The document as claimed claim 29, wherein the hologram is combined with a reflector with narrow band reflectivity.

41. (New) The document as claimed in claim 29, wherein the hologram represents at least one other image appearing in a plane different to that of said deformed copy.

42. (New) The document as claimed in claim 41, wherein said at least one other image can be read at a wavelength different from that of said deformed copy.

43. (New) Document according to claim 29, wherein the hologram comprises data printed on its surface.

44. (New) A document security system, comprising a prerecorded or electrically controllable optical modulator in which an image of at least part of the document is recorded, said modulator configured to be combined with a layer of photosensitive material, at least one first light source configured to transmit a first reference wave to the layer of photosensitive material and a second incident wave onto said modulator and giving rise to a third object wave which is transmitted to the layer of photosensitive material in order to interfere with the reference wave in this layer of photosensitive material, and comprising in a path of the first wave or of the second wave means for inducing scrambling in the hologram recorded in the layer of photosensitive material.

45. (New) The system as claimed in claim 44, further comprising a mirror placed on a side opposite the layer of photosensitive material with respect to the modulator, this mirror receiving the reference wave after passing through the layer of photosensitive material and the modulator and reflecting this reference wave to give rise to the second wave which illuminates the modulator which transmits the third wave to the layer of photosensitive material, the reference and object waves being counter-propagating and perpendicular to planes of the modulator and of the photosensitive layer.

46. (New) The system as claimed in claim 44, further comprising a second source which is coherent like the first source and emitting the second wave, the first and the second

source being located on each side of the modulator assembly and layer of photosensitive material.

47. (New) The system as claimed in claim 44, further comprising, between the modulator and the layer of photosensitive material, an optical device configured to image the modulator in a plane of the layer of photosensitive material.

48. (New) The system as claimed in claim 47, further comprising a beam-splitter plate, the first source supplying the first reference wave to the beam-splitter plate which retransmits this first wave to the layer of holographic material, a second source supplying the second wave, coherent with the first wave, toward the modulator which retransmits the third wave to the layer of holographic material through the optical device and the beam splitter plate.

49. (New) The system as claimed in claim 44, further comprising at least one additional spatial light modulator not located in a plane of said optical modulator and configured to record, in the hologram, at least one additional image appearing, on reading, in a plane different from said image of the part of the document.

50. (New) The system as claimed in claim 49, wherein the additional image and the image of the part of the document are recorded at at least one of different wavelengths and different angles of incidence of the recording beams.

51. (New) The system as claimed in claim 44, wherein the first reference wave and the third object wave are plane, coherent, and collinear waves.

52. (New) The system as claimed in claim 44, wherein said means for inducing scrambling is placed at least substantially against the layer of photosensitive material.

53. (New) A system for reading a document comprising a hologram containing an image of part of said document, said image being scrambled, and comprising a revealer device for correcting said scramblings, said hologram being readable through the revealer.

54. (New) The system as claimed in claim 53, further comprising a marking device configured to position the hologram to be read facing the revealer.

55. (New) The system as claimed in claim 54, further comprising lugs configured to accommodate notches from the document.

56. (New) The system as claimed in claim 53, wherein the revealer comprises optical markers configured to be made to coincide with markers of the document.

IN THE ABSTRACT

Please delete the original Abstract page 21 in its entirety and insert therefor:

ABSTRACT

A document includes at least one drawing or data produced, for example, by printing. In addition, this document includes a hologram representing part of the document. The hologram of this document is recorded using a system including a prerecorded or electrically controllable optical modulator in which the image of at least part of the document is recorded. This modulator is designed to be combined with a layer of photosensitive material. A first reference wave illuminates the layer of photosensitive material. A second wave incident on the modulator and giving rise to a third object wave is also transmitted to the layer of photosensitive material in order to interfere with the reference wave in this layer.

REMARKS

Favorable consideration of this application, as presently amended, is respectfully requested.

The present preliminary amendment is submitted to place the above-identified application in more proper format under United States practice.

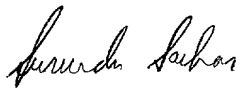
By the present preliminary amendment Claims 1-28 are canceled and new Claims 39-56 are presented for examination. New Claims 29-56 are deemed to be self-evident from the original disclosure, including canceled Claims 1-28, and thus are not deemed to raise any issues of new matter. No differences between new Claims 29-56 and canceled Claims 1-28 are believed to narrow the scope of new Claims 29-56.

A new Abstract believed to be in more proper format under United States practice is also submitted herein.

The present application is believed to be in condition for a full and thorough examination on the merits. An early and favorable consideration of the present application is hereby respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Gregory J. Maier
Registration No. 25,599
Attorney of Record
Surinder Sachar
Registration No. 34,423



22850

(703) 413-3000
Fax #: (703) 413-2220
GJM:SNS/smi

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Serial No:

Amendment Filed on:

1-9-2002

IN THE CLAIMS

Claims 1-28 (Canceled).

Claims 29-56 (New).

IN THE ABSTRACT

(New).

**SECURED DOCUMENT, SYSTEM FOR MANUFACTURING SAME AND
SYSTEM FOR READING THIS DOCUMENT**

5 The invention relates to a secured document, a process
and a system making it possible to manufacture this
document and means making it possible to read it.

10 It is now relatively easy for forgers to reproduce
conventional documents such as passports, identity
card, identification badges.

15 The object of the invention is to make it difficult, or
even virtually impossible, to reproduce and/or falsify
such documents.

20 Securing documents (identity cards, passports, etc.)
against counterfeiting and falsification is a
fundamental problem which arises with all those
involved in the field.

25 The restrictions which bear on the securing methods are
stringent. This is because these documents must be made
with:

- 25 - a very low production cost (a few tens of
centimes per document)
- a short duration for the process allowed for
the manufacture of each document (a few seconds
per document)
- 30 - a high level of protection against
counterfeiting.

35 Generally, the object of the invention is to produce,
on the document to be protected, a characteristic
hologram which is difficult to copy and moreover which
carries printed data in a conventional manner on the
document. Thus a verifying agent will be able to check
the document by comparing the content of the hologram
with the content of the rest of the document. For

example, the hologram represents an image of the identity photo contained on the document. Comparing the image of the hologram with the image of the photo makes it possible to authenticate the document quickly and easily.

Processes for securing documents, for example by hologram, are known from documents US-A-4 171 864, EP-A-0 283 233, GB-A-2 254 166, US-A-3 894 756 and US-A-5 483 363, but these known processes do not offer strengthened security against counterfeiting.

The invention therefore relates to a document comprising at least one drawing or data, made by deposition or inclusion of pigments or dyes which can be read optically, and a hologram made from a copy of said drawing or of said data, characterized in that the hologram comprises deformations introduced during its recording which makes the copy read from the drawing or said data different.

The invention also relates to a document security system, comprising a prerecorded or electrically controllable optical modulator in which the image of at least part of the document is recorded, said modulator being designed to be combined with a layer of photosensitive material, at least one first light source making it possible to transmit a first reference wave to the layer of photosensitive material and a second incident wave onto said modulator and giving rise to a third object wave which is transmitted to the layer of photosensitive material in order to interfere with the reference wave in this layer, characterized in that it comprises in the path of the first wave or of the second, means inducing scrambling in the hologram recorded in the layer of photosensitive material.

The invention also relates to a system for reading a document comprising a hologram containing an image of part of said document, said image being scrambled, characterized in that it comprises a device for
 5 correcting said scramblings, or revealer, said hologram being readable through the revealer.

The various objects and characteristics of the invention will become more clearly apparent in the
 10 following description given by way of example and in the appended figures which represent:

- figures 1a and 1b, examples of documents secured according to the invention;
- figures 2 to 4c, examples of hologram recording
 15 systems according to the invention;
- figures 5 and 6, recording systems making it possible to induce scramblings in the images recorded in the holograms;
- figures 7 and 8, systems making it possible to
 20 read a hologram by removing scramblings contained in the hologram;
- figures 9 and 10, a device for reading a document furnished with a hologram and making it possible to remove scramblings induced in the hologram;
- 25 - figures 11 and 12, documents incorporating special gratings placed against the holograms.

An example of a document secured according to the invention will first of all be described with reference
 30 to figure 1a. By way of example, figure 1 shows an identity card 1 comprising data 4 indicating the identity of the possessor of the card, his or her photograph 2 and his or her signature 5. Furthermore, according to the invention, the card comprises a
 35 hologram 3 in which one or more elements for personalizing the card have, *inter alia*, been recorded, such as the photograph, the signature, etc. In figure

1, the photograph has been chosen for recording in the hologram. A card of this type would thus be more difficult to falsify since the hologram contains data for personalizing the card, which will change from one
5 card to another.

Figure 1b shows a variant embodiment of figure 1a. According to this variant the hologram 3 contains images which appear in different planes. An image 60
10 may be, for example in the case of an identity card, a copy of the identity photo 2, whilst another image 61 may be either a standard image (logo) or other data from the card such as the copy of the signature 5. According to another variant (not shown), the hologram
15 may also comprise data printed on its surface. A first example of the process of recording the hologram will now be described with reference to figure 2.

20 A support element 22 is coated on one of its faces with a layer of photosensitive material 21. An optical modulator 23, such as a transparent photographic support or a controllable modulator such as a liquid-crystal screen, is applied near to or in contact with
25 the layer of photosensitive material.

Preferably, the modulator makes it possible to supply the contents (data or image) of part of the document to be secured. If this involves a prerecorded modulator of
30 the transparency type, this part of the document is recorded in the modulator. If this involves a controllable modulator, the part of the document can be displayed using the control of the modulator.

35 The support element 22 is transparent at the recording wavelength. A mirror 24 is placed on the side opposite the photosensitive layer with respect to the modulator

23. A light beam R supplied by a source S1 and carrying a coherent wave illuminates the support element 22. By way of example, in figure 2, this light beam is perpendicular to the plane of the support element 22 and of the photosensitive layer 21. The beam R passes through the support 22, the holography layer 21. It is modulated by the modulator 23 and is transmitted to the mirror 24. The latter reflects the modulated beam which passes back through the modulator. According to this embodiment, the mirror 24 is perpendicular to the direction of the beam and reflects a beam colinearly with the incident beam. The reflected modulated beam interferes with the beam R in the layer of photosensitive material. The modulation carried by the modulated beam is therefore recorded in the photosensitive layer. Thus, a hologram containing data or an image, which is a copy of data or of an image contained in the document to be secured, has been recorded. If the modulator 23 contains, for example, the photograph of the possessor of the identity card, this photo has therefore been recorded in the hologram.

In this process, it is assumed that T is the transmission coefficient of the modulator and that O is the wave illuminating the hologram on the side opposite the beam R, which we will call reference wave R hereinafter.

The function recorded by the hologram comes from the interference between the reference wave R and the wave $O \sim R^*T$, the object wave from the transparency.

The hologram records $R(R^*T^2)^*$ i.e. RRT^2 .

If the hologram is thick, it will rediffract on reading the recorded image, for specified angles of incidence (Bragg effect) of the illumination wave and of the

viewing direction.

The modulator can integrate a scattering function for improved reading of the hologram and in order to
 5 complicate any counterfeiting.

Figure 3 shows another recording process in which two waves illuminating the photosensitive layer are needed. The light modulator 23 is placed against the layer of
 10 photosensitive material 21 borne by the support 22.

An illuminating reference wave R supplied by the source S1 is transmitted to the layer of photosensitive material 21 without passing through the modulator. An
 15 illumination wave I supplied by the source S2 illuminates the modulator 23 and is transmitted therethrough to the layer of photosensitive material (illumination wave O, $O = IT$). The two waves R and O interfere in the photosensitive material 21.
 20 Preferably, the two waves O and R are counterpropagating and are perpendicular to the plane of the layer of photosensitive material 21. Also, preferably, the two waves are coherent plane waves.

25 The function recorded by the hologram comes from interference between R, reference wave, and the object wave coming from the modulator illuminated by the plane wave I: $O = IT$.

30 The hologram records $R^*.I.T$.

The thick hologram reilluminated by a plane wave R will diffract an image proportional to IT , that is to say, the image of the transparency, provided that I is of
 35 the plane wave type, like R.

As in figure 2, the modulator 23 of figure 3 can be

integrated into a scattering function. For example, a layer of scattering material will be deposited on the face of the modulator located on the side of the layer of photosensitive material.

5

In the above, the recording of the hologram 21 has been carried out by placing thereagainst an optical modulator. It is also possible to design a recording system in which the modulator is illuminated by a wave I, which is modulated by the modulator and which supplies a wave O, as is shown in figure 4a. An optical device 80 images the modulator in the plane of the hologram. Moreover, a beam-splitter plate 81 placed in the path of the wave O makes it possible to transmit a reference wave R to the photosensitive medium 21. This reference wave interferes with the wave O and makes it possible to record the image supplied by the modulator 23. The rereading of such a hologram requires placing a mirror against the support 22 on the side opposite the hologram 21.

Figures 4b and 4c represent variants of recording systems in which the modulator is not placed against the hologram. As can be seen in figure 4b, the modulator 23 is illuminated by the wave I and is projected by the optic 80, onto the surface of the layer of photosensitive material 21 (wave $O = IT$). Moreover, the layer of photosensitive material is illuminated by a reference wave R incident on this layer from the side opposite the modulator. The two waves O and R interfere in the photosensitive layer in order to record a hologram corresponding to the display of the modulator 23. As is known in the prior art, the waves O and R are preferably coherent.

35

Figure 4c shows the system of figure 4b in which one or more additional light modulators 27, 28 have been

provided. These modulators are not placed in the same plane as the modulator 23. These modulators will make it possible to record, in the photosensitive layer of the holograms which will not appear in the same plane as the image of the modulator 23.

Preferably, the images of the various modulators will be recorded separately. The image of the modulator 23 will be recorded when the modulators 27 and 28 are transparent or in the absence of these modulators. In order to record the image of an additional modulator, 27 for example, the modulator 23 will be made transparent (or removed) possibly together with the modulator 28.

It should be noted that the various holograms recorded using the various modulators can be recorded using different wavelengths insofar as the nature of the photosensitive layer 21 allows it. These holograms will then be reread using these various wavelengths.

The variant of figure 4c making it possible to record visible holograms in different planes is also applicable to the systems of figures 2 and 3 by also providing one or more additional modulators on the path of one of the waves I or R.

These additional modulators will make it possible to display either a specific motif (logo) or data (a signature for example) of the document to be secured.

In order to induce a scattering effect and/or aberrations in the hologram, the means inducing the scattering and/or the aberration can be placed either in the path of the wave O or in the path of the wave R.

Figures 5 and 6 show variants of the systems of figures

2 and 3, respectively, in which optical aberrator devices are provided.

Thus, in figure 5, an aberrator 25 is positioned, for example, on the reference wave R. An aberrator introduces a local phase ϕ into the wave R, that is to say, it transforms it into $R.e^{i\phi}$.

The modulator is also illuminated by $R.e^{i\phi}$ and the object wave O is $O = R^*.e^{-i\phi}T^2$. The hologram records $R(.R^*e^{i\phi}T^2)^*$, i.e. $RR.e^{2i\phi}T^2$.

In reading mode, illuminated by R^* , it diffracts a wave $e^{2i\phi}RT^2$ deformed with respect to RT^2 . The image appears scrambled to the observer. The observer can read normally only a deformed image. The deformation undergone by the image is twice that coming from the aberrator.

If the aberrator 25 is located on the modulator side with respect to the layer of photosensitive material, the hologram records $R^*.R.T^2.e^{2i\phi}$. This case is similar to the case of recording 2 waves treated below.

In figure 6, the system is illuminated by two distinct waves I and R supplied by sources S1 and S2 as in figure 3.

The aberrator is positioned, for example, in the path of the wave R. The aberrator introduces a local phase ϕ into the wave R, that is to say, it transforms it into $R.e^{i\phi}$.

The transparency is illuminated by a plane wave I. We therefore have $O = IT$.

The hologram records $R^*.e^{i\phi} IT$.

In reading, reilluminated by R, it diffracts a wave $e^{i\phi}$ IT deformed with respect to IT. The image appears scrambled to the observer, as above.

5

The deformation undergone by the image is the same as that coming from the aberrator.

Under these conditions, in order to be able to reread
10 the images recorded using the systems of figures 5 and 6, it is necessary to correct the aberrations introduced by the aberrator.

For this purpose, according to the invention, an
15 aberration-correcting device 27, which we will call a revealer 27, is placed (figure 7) in front of the hologram thus recorded, through which it is possible to read the hologram corrected of the aberrations.

20 The revealer induces a phase function the inverse of that of the aberrator, that is $e^{-i\phi}$, on the read wave.

The wave incident on the hologram is $Re^{-i\phi}$. Since the hologram has recorded $R.Re^{2i\phi}T^2$, it diffracts a wave
25 proportional to $T^2.e^{i\phi}$ then passes back through the revealer which again induces $e^{-i\phi}$ and thus the light wave coming from the revealer is proportional to T, that is to say corresponds to the undeformed image.

30 Therefore, with a recording such as that of figure 6, (aberrator on the reference wave side), the aberrator induces ϕ , the revealer must induce $-\phi$.

Where the aberrator has been positioned on the
35 modulator side, the revealer is determined as in the two-wave case described below.

According to figure 8, the revealer induces a phase function of $e^{-i\phi/2}$ on the read wave.

The wave incident on the hologram is $R.e^{i\phi/2}$. Since the
 5 hologram has recorded $R^*ie^{i\phi}T$, it diffracts a wave proportional to $T.e^{i\phi/2}$ then passes back through the revealer which again induces $e^{-i\phi/2}$ and thus the light wave coming from the revealer is proportional to IT , that is to say it corresponds to the undeformed image.

10

Therefore with 2 wave recording: the aberrator induces ϕ and the revealer must induce $-\phi/2$.

15

In order that the positioning of the revealer is not too critical, the aberrator must be chosen so as to noticeably modify the view of the image but with phase defect spatial frequencies on the scale of the positioning accuracy tolerated.

20

1°/ 1 or 2 wave recording can be carried out with any incident waves. The benefit is, *inter alia*, to separate the direction of observing the recorded image from the specular reflection. This configuration substantially improves the image contrast.

25

2°/ In figure 2, a nonspecular mirror can be used in recording so as to modify the angle of incidence of the object wave with respect to that of the reference wave, namely to separate the direction of observing the photo
 30 from the specular reflection.

3°/ The aberrator and the revealer are two different phase functions. It is possible to use the same component for both functions by reilluminating the
 35 hologram not with R but with R^* . In this case, the phase function recorded in the hologram is transformed

into its conjugate by diffraction and self-corrects by passing through this same phase law. This is the principle of phase conjugation.

5 A hologram of this sort is thus made difficult to counterfeit by the presence of the aberrator during recording:

- knowledge of the correct aberration function to be used is not easy to acquire. This analysis
- 10 can be made difficult by superimposing a scattering function on the diffracted function;
- on the assumption that the aberrant function to be used during recording has been determined, the practical construction of a known phase law
- 15 aberrator is not easy.

Figure 9 shows a device for reading a document furnished with a hologram recorded with aberrations. This device comprises a revealer 27 which must be

20 accurately positioned with respect to the hologram in order to allow sufficient correction of the aberrations. According to figure 8, the document which bears the hologram or the hologram support comprises positioning means such as notches 30 to 33. The read

25 device comprises lugs or pads 40 to 43, the complement of the notches, so that the document is placed correctly in front of the revealer.

According to a variant embodiment (figure 10), instead

30 of notches, the document may comprise optical marks 34

CLAIMS

1. A document comprising at least one drawing or data
produced by deposition or inclusion of pigments or
dyes which can be read optically, and a hologram
made from a copy of said drawing or said data,
characterized in that the hologram comprises
deformations introduced during its recording which
make the copy read from the drawing or from said
data different.
2. The document as claimed in claim 1, characterized
in that the deformations are aberrations.
3. The document as claimed in claim 1 or 2,
characterized in that the deformations are
scattering effects.
4. The document as claimed in one of the preceding
claims, characterized in that the hologram is
superimposed onto at least one photosensitive
layer with a coding function (HS).
5. The document as claimed in claim 4, characterized
in that said photosensitive layer is a diffraction
grating.
6. The document as claimed in claim 4 or 5,
characterized in that said photosensitive layer
contains specific but not personalized data,
identical for all documents of the same type.
7. The document as claimed in one of claims 4 to 6,
characterized in that the coding function
comprises at least one of the following optical
properties: colorimetry with multiple angular
ranges of visibility, high-resolution visible with
an additional source.

8. The document as claimed in one of claims 4 to 7, characterized in that the man [sic] and the photosensitive layer are combined by "anti-peel" bonding means.

5

9. The document as claimed in one of the preceding claims, characterized in that the hologram is transparent so that data located under it, on the document, can be read.

10

10. The document as claimed in one of the preceding claims, characterized in that the hologram can be read only under lighting of certain wavelengths.

15

11. The document as claimed in one of the preceding claims, characterized in that the hologram can be read at different wavelengths from different angles.

20

12. The document as claimed in one of the preceding claims, characterized in that the hologram is combined with a reflector with narrow band reflectivity.

25

13. The document as claimed in one of the preceding claims, characterized in that the hologram represents at least one other image appearing in a plane different to that of said deformed copy.

30

14. The document as claimed in claim 13, characterized in that said image can be read at a wavelength different from that of said deformed copy.

35

15. Document according to one of the preceding claims, characterized in that the hologram comprises data printed on its surface.

16. A document security system, comprising a prerecorded or electrically controllable optical modulator (23) in which the image of at least part of the document is recorded, said modulator being
5 designed to be combined with a layer of photosensitive material (21), at least one first light source making it possible to transmit a first reference wave (R) to the layer of photosensitive material and a second incident wave
10 (I) onto said modulator (23) and giving rise to a third object wave (O) which is transmitted to the layer of photosensitive material in order to interfere with the reference wave (R) in this layer, characterized in that it comprises in the
15 path of the first wave or of the second of means (25) inducing scrambling in the hologram recorded in the layer of photosensitive material.
17. The system as claimed in claim 16, characterized
20 in that it comprises a mirror (24) placed on the side opposite the layer of photosensitive material (21) with respect to the modulator, this mirror receiving the reference wave (R) after passing through the layer of photosensitive material and
25 the modulator and reflecting this wave in order to give rise to the second wave (I) which illuminates the modulator which transmits the third wave (O) to the layer of photosensitive material, the
30 reference (R) and object (O) waves being counterpropagating and perpendicular to the planes of the modulator and of the photosensitive layer.
18. The system as claimed in claim 16, characterized
35 in that it comprises a second source which is coherent like the first source and emitting the second wave (I), the first and the second source being located on each side of the modulator

assembly and layer of photosensitive material.

19. The system as claimed in claim 16, characterized
in that it comprises, between the modulator (23)
and the layer of photosensitive material (21), an
optical device (80) making it possible to image
the modulator (23) in the plane of the layer of
photosensitive material (21).
20. The system as claimed in claim 19, characterized
in that it comprises a beam-splitter plate (81),
the first source supplying the first reference
wave (R) to the beam-splitter plate which
retransmits this first wave to the layer of
holographic material, a second source supplying
the second wave (I), coherent with the first,
toward the modulator which retransmits the third
wave (A) to the layer of holographic material
through the optical device (80) and the beam-
splitter plate (81).
21. The system as claimed in either of claims 16 to
19, characterized in that it comprises at least
one additional spatial light modulator (27, 28)
not located in the plane of said optical modulator
(23) and making it possible to record, in the
hologram, at least one additional image appearing,
on reading, in a plane different from said image
of the part of the document.
22. The system as claimed in claim 21, characterized
in that the additional image and the image of the
part of the document are recorded at different
wavelengths and/or different angles of incidence
of the recording beams.
23. The system as claimed in one of claims 16 to 19,

characterized in that the first reference wave (R) and the third object wave (O) are plane, coherent and collinear waves.

5 24. The system as claimed in one of claims 16 to 23, characterized in that said means inducing scrambling are placed against or almost against the layer of photosensitive material.

10 25. The system for reading a document comprising a hologram containing an image of part of said document, said image being scrambled, characterized in that it comprises a device for correcting said scramblings, or revealer (27), said hologram being readable through the revealer.

15 26. The system as claimed in claim 25, characterized in that it comprises a marking device making it possible to position the hologram to be read facing the revealer (27).

20 27. The system as claimed in claim 26, characterized in that it comprises lugs intended to accommodate notches from the document.

25 28. The system as claimed in claim 25, characterized in that the revealer comprises optical markers intended to be made to coincide with the markers of the document.

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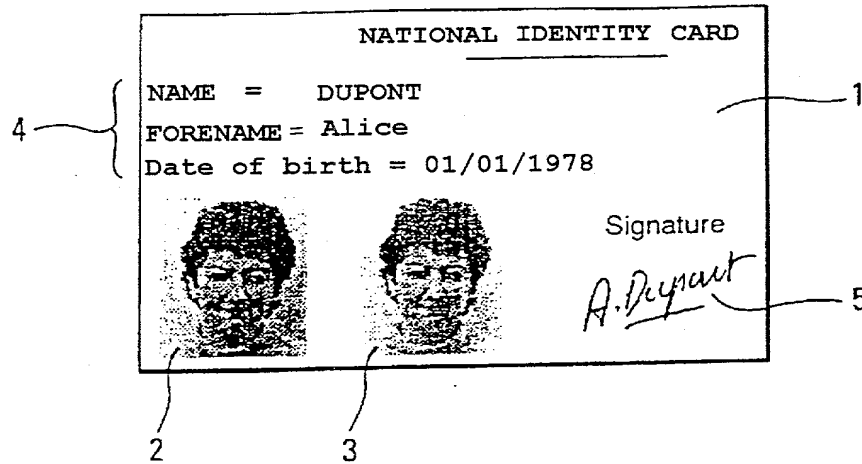


Fig. 1a

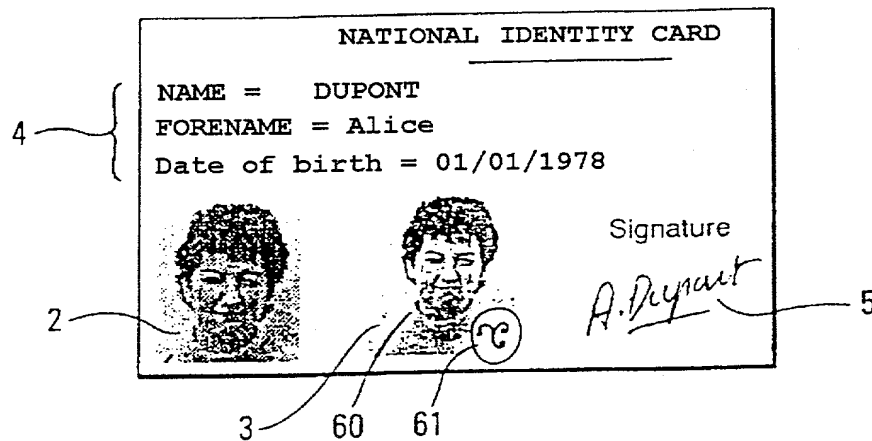


Fig. 1b

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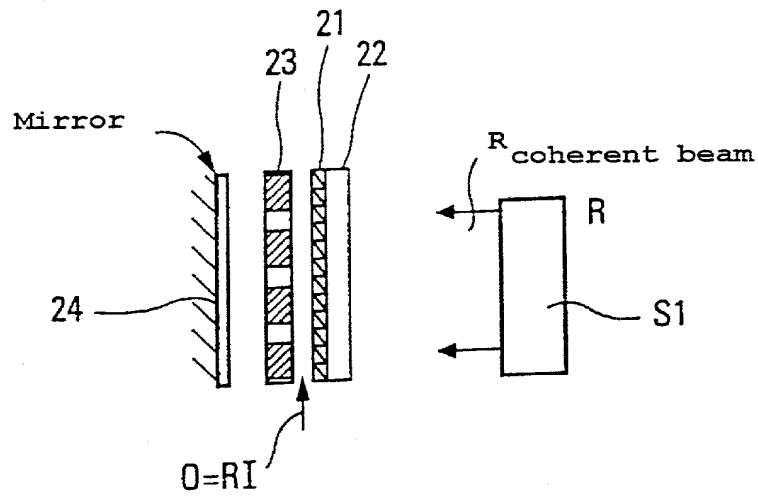


Fig. 2

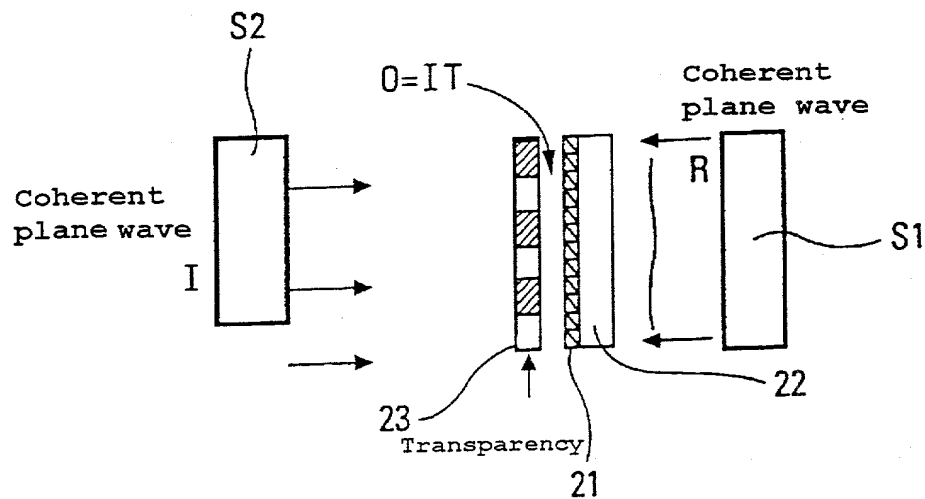
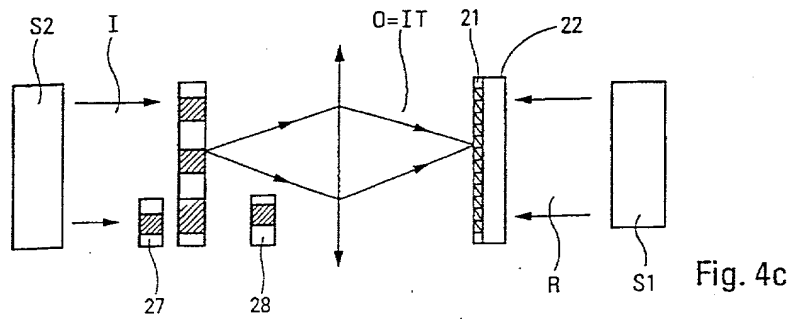
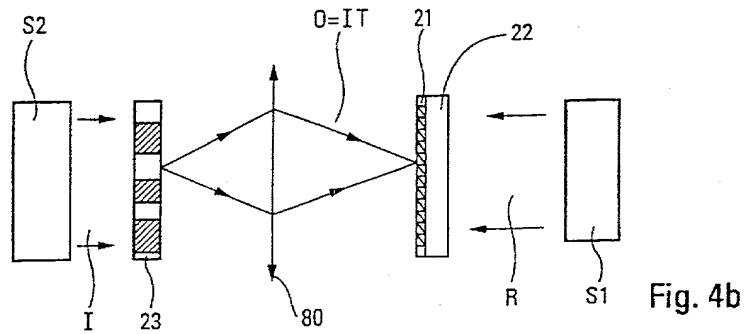
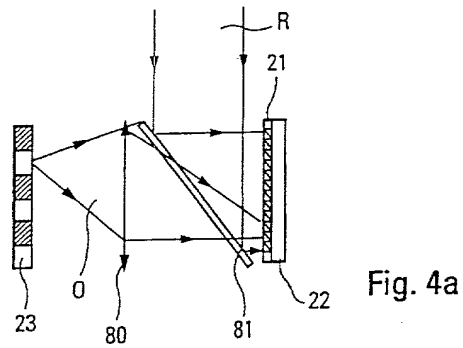


Fig. 3

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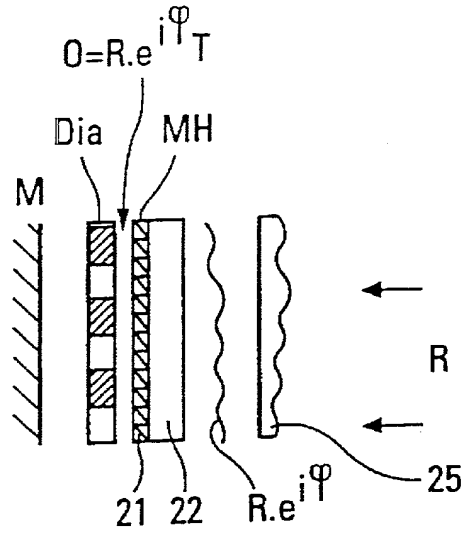


Fig. 5

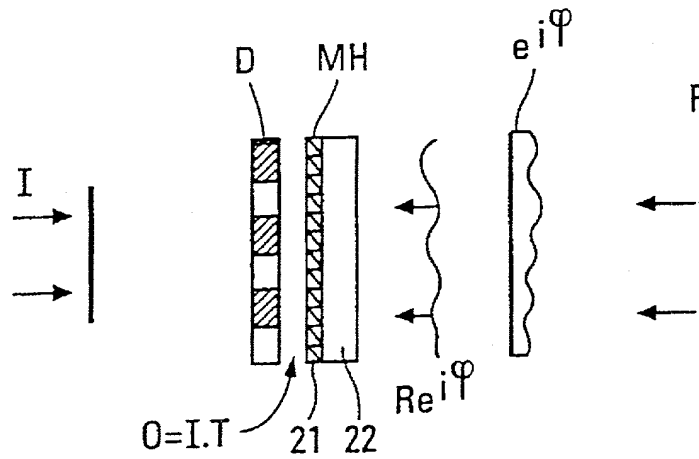


Fig. 6

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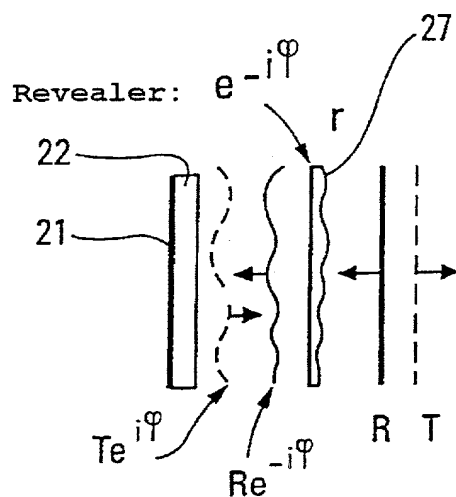


Fig. 7

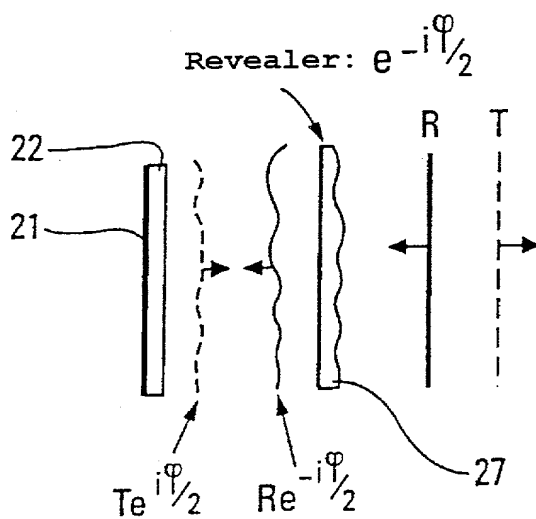


Fig. 8

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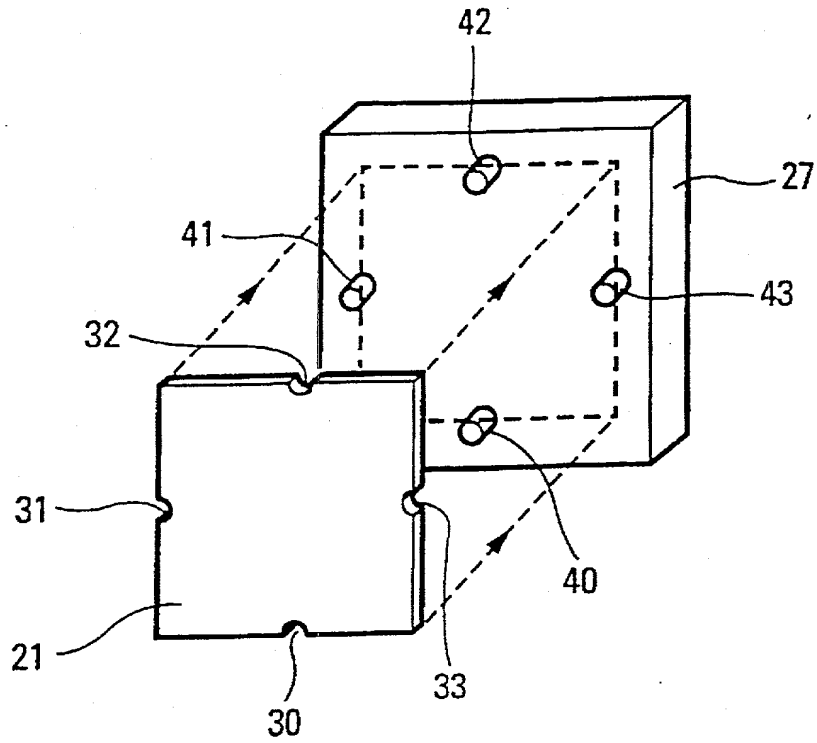


Fig. 9

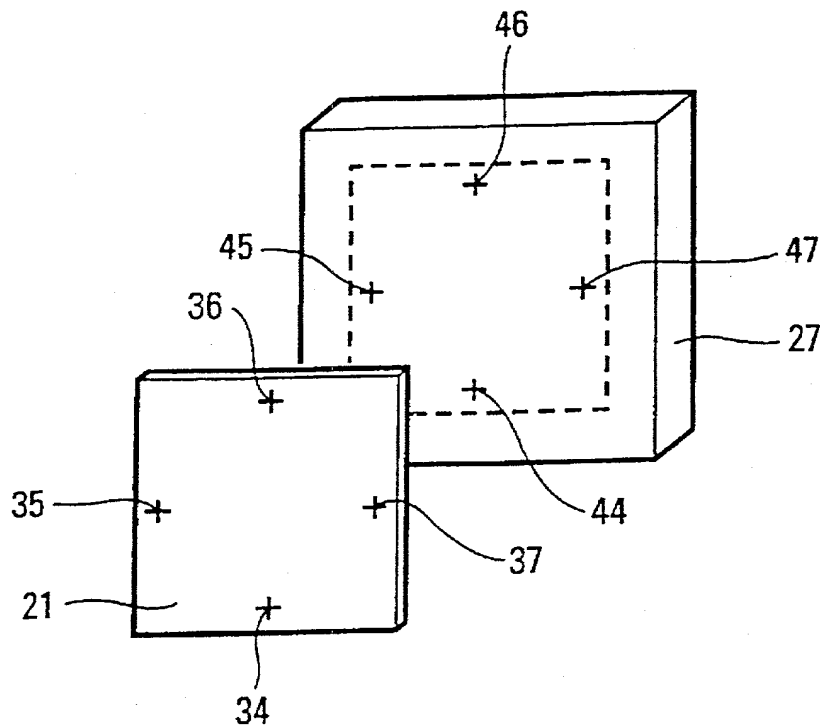
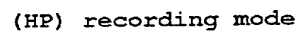


Fig. 10

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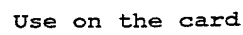


Fig. 12

Declaration and Power of Attorney for Patent Application

Déclaration et Pouvoirs pour Demande de Brevet

French Language Declaration

En tant l'inventeur nommé ci-après, je déclare par le présent acte que:

Mon domicile, mon adresse postale et ma nationalité sont ceux figurant ci-dessous à côté de mon nom.

Je crois être le premier inventeur original et unique (si un seul nom est mentionné ci-dessous), ou l'un des premiers co-inventeurs originaux (si plusieurs noms sont mentionnés ci-dessous) de l'objet revendiqué, pour lequel une demande de brevet a été déposée concernant l'invention intitulée

et dont la description est fournie ci-joint à moins

☐ ci-joint

☐ a été déposée le _____

sous le numéro de demande des Etats-Unis ou le numéro de demande international PCT

_____ et modifiée le

_____ (le cas échéant).

Je déclare par le présent acte avoir passé en revue et compris le contenu de la description ci-dessus, revendications comprises, telles que modifiées par toute modification dont il aura été fait référence ci-dessus.

Je reconnais devoir divulguer toute information pertinente à la brevetabilité, comme défini dans le Titre 37, § 1.56 du Code fédéral des réglementations.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

SECURED DOCUMENT, SYSTEM FOR

MANUFACTURING SAME AND SYSTEM FOR

READING THIS DOCUMENT

the specification of which:

☐ is attached hereto.

☒ was filed on July 4, 2000

as United States Application Number or PCT International Application Number

PCT/FR00/01914 and was amended on

_____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

French Language Declaration

Je revendique par le présent acte avoir la priorité étrangère, en vertu du Titre 35, § 119(a)-(d) ou § 365(b) du Code des Etats-Unis, sur toute demande étrangère de brevet ou certificat d'inventeur ou, en vertu du Titre 35, § 365(a) du même Code, sur toute demande internationale PCT désignant au moins un pays autre que les Etats-Unis et figurant ci-dessous et, en cochant la case, j'ai aussi indiqué ci-dessous toute demande étrangère de brevet, tout certificat d'inventeur ou toute demande internationale PCT ayant une date de dépôt précédant celle de la demande à propos de laquelle une priorité est revendiquée.

I hereby claim foreign priority under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below, and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)
Demande(s) de brevet antérieure(s) dans un autre pays.

Priority claimed
Droit de priorité
revendiqué

99 08958 FRANCE
(Number) (Country)
(Numéro) (Pays)

9 JULY 1999
(Day/Month/Year Filed)
(Jour/Mois/Anné de dépôt)

☒ ☐
Yes No
Oui Non

(Number) (Country)
(Numéro) (Pays)

(Day/Month/Year Filed)
(Jour/Mois/Anné de dépôt)

☐ ☐
Yes No
Oui Non

Je revendique par le présent acte tout bénéfice, en vertu du Titre 35, § 119(e) du Code des Etats-Unis, de toute demande de brevet provisoire effectuée aux Etats-Unis et figurant ci-dessous.

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

(Application No.)
(N° de demande)

(Filing Date)
(Date de dépôt)

(Application No.)
(N° de demande)

(Filing Date)
(Date de dépôt)

Je revendique par le présent acte tout bénéfice, en vertu du Titre 35, § 120 du Code des Etats-Unis, de toute demande de brevet effectuée aux Etats-Unis, ou en vertu du Titre 35, § 365(c) du même Code, de toute demande internationale PCT désignant les Etats-Unis et figurant ci-dessous et, dans la mesure où l'objet de chacune des revendications de cette demande de brevet n'est pas divulgué dans la demande antérieure américaine ou internationale PCT, en vertu des dispositions du premier paragraphe du Titre 35, § 112 du Code des Etats-Unis, je reconnais devoir divulguer toute information pertinente à la brevetabilité, comme défini dans le Titre 37, § 1.56 du Code fédéral des réglementations, dont j'ai pu disposer entre la date de dépôt de la demande antérieure et la date de dépôt de la demande nationale ou internationale PCT de la présente demande:

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

PCT/FR00/01914
(Application No.)
(N° de demande)

July 4, 2000
(Filing Date)
(Date de dépôt)

(Status) (patented, pending, abandoned)
(Statut) (breveté, en cours d'examen, abandonné)

(Application No.)
(N° de demande)

(Filing Date)
(Date de dépôt)

(Status) (patented, pending, abandoned)
(Statut) (breveté, en cours d'examen, abandonné)

Je déclare par le présent acte que toute déclaration ci-incluse est, à ma connaissance, véridique et que toute déclaration formulée à partir de renseignements ou de suppositions est tenue pour véridique; et de plus, que toutes ces déclarations ont été formulées en sachant que toute fausse déclaration volontaire ou son équivalent est passible d'une amende ou d'une incarcération, ou des deux, en vertu de la Section 1001 du Titre 18 du Code des Etats-Unis, et que de telles déclarations volontairement fausses risquent de compromettre la validité de la demande de brevet ou du brevet délivré à partir de celle-ci.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

French Language Declaration

POUVOIRS: En tant que l'inventeur cité, je désigne par la présente l'(les) avocat(s) et/ou agent(s) suivant(s) pour qu'ils poursuive(nt) la procédure de cette demande de brevet et traite(nt) toute affaire s'y rapportant avec l'Office des brevets et des marques: (mentionner le nom et le numéro d'enregistrement).

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)

Norman F. Oblon, Reg. No. 24,618; Marvin J. Spivak, Reg. No. 24,913; C. Irvin McClelland, Reg. No. 21,124; Gregory J. Maier, Reg. No. 25,599; Arthur I. Neustadt, Reg. No. 24,854; Richard D. Kelly, Reg. No. 27,757; James D. Hamilton, Reg. No. 28,421; Eckhard H. Kuesters, Reg. No. 28,870; Robert T. Pous, Reg. No. 29,099; Charles L. Gholz, Reg. No. 26,395; Vincent J. Sunderdick, Reg. No. 29,004; William E. Beaumont, Reg. No. 30,996; Steven B. Kelber, Reg. No. 30,073; Robert F. Gruse, Reg. No. 27,295; Jean-Paul Lavalleye, Reg. No. 31,451; Stephen G. Baxter, Reg. No. 32,884; Martin M. Zoltick, Reg. No. 35,745; Robert W. Hahl, Reg. No. 33,893; Richard L. Treanor, Reg. No. 36,379; Steven P. Weihrouch, Reg. No. 32,829; John T. Goolkasian, Reg. No. 26,142; Marc R. Labgold, Reg. No. 34,651; William J. Healey, Reg. No. 36,160; Richard L. Chinn, Reg. No. 34,305; Steven E. Lipman, Reg. No. 30,011; Carl E. Schlier, Reg. No. 34,426; James J. Kulbaski, Reg. No. 34,648; Catherine B. Richardson, Reg. No. 39,007; Richard A. Neifeld, Reg. No. 35,299; and J. Derek Mason, Reg. No. 35,270, with full powers of substitution and revocation.

Addresser toute correspondance à:

Send Correspondence to:

OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
FOURTH FLOOR
1755 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VIRGINIA 22202 U.S.A.

Adresser tout appel téléphonique à:
(nom et numéro de téléphone)

Direct Telephone calls to: (name and telephone number)

(703) 413-3000

Nom complete de l'unique ou premier inventeur <div style="text-align: right;">180</div>	Full name of sole or first inventor Cécile JOUBERT December 17, 2001
Signature de l'inventeur Date	Inventor's signature Date <i>Cécile Joubert</i>
Domicile	Residence 91400 ORSAY FRX FRANCE
Nationalité	Citizenship French
Adresse Postale	Post Office Address 13, allée de Chiraz
	91400 ORSAY FRANCE
Nom complete du second co-inventeur, le cas echeant <div style="text-align: right;">200</div>	Full name of second joint inventor, if any Brigitte LOISEAUX December 17, 2001
Signature de l'inventeur Date	Second inventor's signature Date <i>Brigitte Loiseaux</i>
Domicile	Residence 91440 BURES S/YVETTE FRX FRANCE
Nationalité	Citizenship French
Adresse Postale	Post Office Address 13, avenue Jules Verne
	91440 BURES S/YVETTE FRANCE

(Fournir les mêmes renseignements et la signature de tout co-inventeur supplémentaire.)

(Supply similar information and signature for third and subsequent joint inventors.)

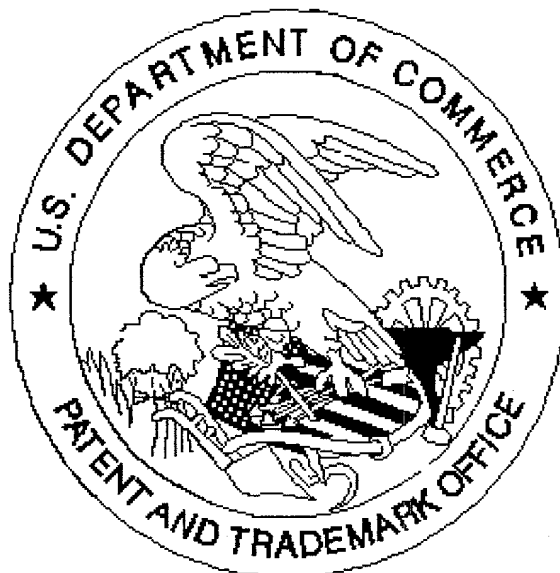
French Language Declaration

Nom complete de l'unique ou premier inventeur 300	Full name of third joint inventor, if any Philippe ROBIN December 17, 2001
Signature de l'inventeur Date	Third inventor's signature Date <i>Philippe Robin</i>
Domicile	Residence 92340 BOURG LA REINE FRANCE
Nationalité	Citizenship French FRX
Adresse Postale	Post Office Address 22, rue Armand Millet
	92340 BOURG LA REINE FRANCE
Nom complete du second co-inventeur, le cas echeant 400	Full name of fourth joint inventor, if any Claude BRICOT December 17, 2001
Signature de l'inventeur Date	Fourth inventor's signature Date <i>Claude Bricot</i>
Domicile	Residence 94800 VILLEJUIF FRANCE
Nationalité	Citizenship French FRX
Adresse Postale	Post Office Address 27 bis, rue Ambroise Croizat
	94800 VILLEJUIF FRANCE
Nom complete du second co-inventeur, le cas echeant	Full name of fifth joint inventor, if any
Signature de l'inventeur Date	Fifth inventor's signature Date
Domicile	Residence
Nationalité	Citizenship
Adresse Postale	Post Office Address
Nom complete du second co-inventeur, le cas echeant	Full name of sixth joint inventor, if any
Signature de l'inventeur Date	Sixth inventor's signature Date
Domicile	Residence
Nationalité	Citizenship
Adresse Postale	Post Office Address

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